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# Writing the Next American Hit: Using GPT-2 to Explore the Possibility of Creating Successful AI-Generated Song Lyrics

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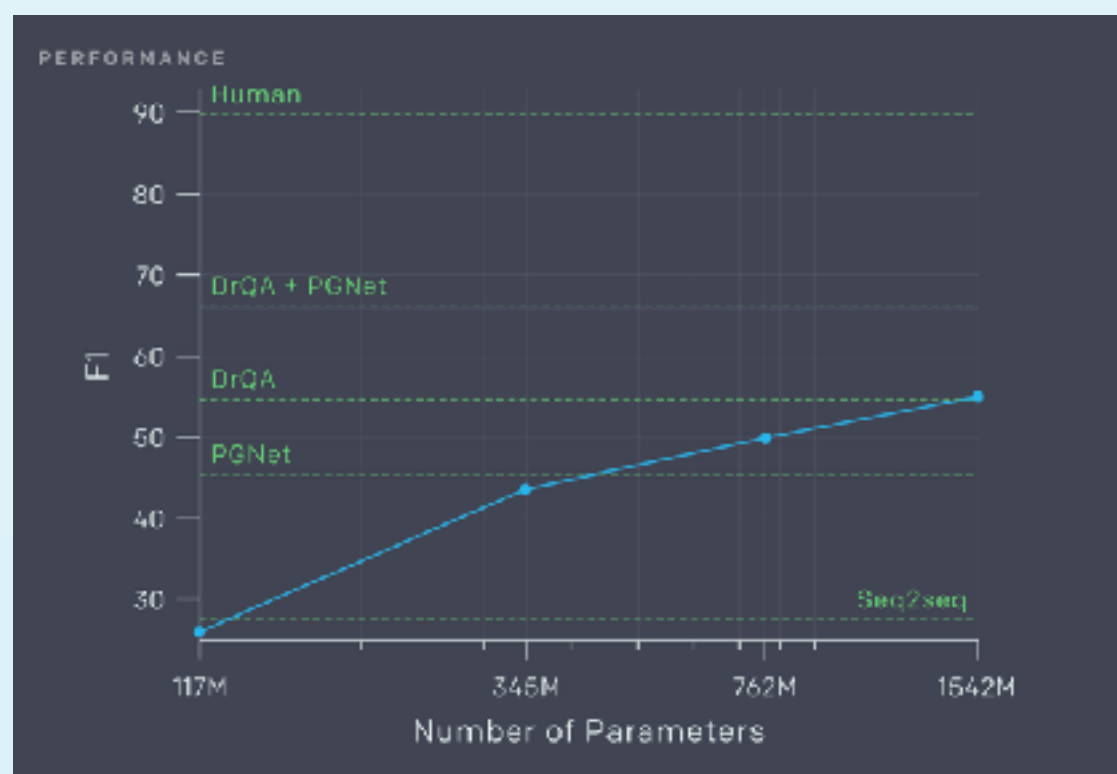
## Introduction

In the Information Age, the line between humans and artificial intelligence has grown smaller and smaller with each day. In a world where the capabilities of AI has grown exponentially, AI has been able to infiltrate our creative realms and processes from successfully composing music to creating aesthetically pleasing art. However, AI is still lacking in the written language, such as storytelling and lyric writing. Natural Language Processing remains one of the hardest tasks for computers to perfect, because, unlike AI, humans have the ability to recognize flaws in language outside of the realm of grammar and proper sentence formulation.

What's important to note is that this language processing system can be trained to “generate” or predict a sequence based off of text supplied by a user on its own rather than performing specific trained tasks. This means that you can retrain the system on the complete works of a musician, in order for it to create its own specialized song lyrics in their style. When paired up against lyrics written by one of today's most successful songwriters, how well can a computer compete? Are humans really as original and unique as they seem to be? Or can anybody do it? Even a computer.

## Background of Technology

GPT-2 (the successor to OpenAI's GPT, Generative Pre-Trained Transformer) is an unsupervised transformer language model with the objective of predicting the next word from a previous given set of words. In order to imitate human text, the model is trained via likelihood training. This means that the model is trained on a corpus of 40 GB called Webtext, built from a dataset compiled from 8 million web pages of text from Reddit submissions that have been upvoted at least three times. This upvote requirement works to eliminate any faulty or spam text that may have been generated by bots. The system has been restricted to GPT-2's 345 million parameter's model for memory purposes.



## The Success of Taylor Swift

10-time Grammy award-winning musician Taylor Swift is one of the most successful singer-songwriters of our time. After signing a record deal at age 15, she became the youngest artist at the time to win Album of the Year at the Grammy Awards at 20. Last year, *Billboard* named Swift “Woman of the Decade” and was declared “Artist of the Decade” at the American Music Awards. Despite her success, Swift is one of the most polarizing contemporary artists, yielding as many critics as she does fans. Swift's notoriously autobiographical lyrics are heavily criticized for being riddled with cliché love tropes. At the same time, her lyrics are praised for their accessibility. Her personal songwriting simultaneously remains so universal that millions of people can relate to them. She paints subtly complex stories that fans often claim to be ripped out of their own journals.

"I'm intimidated by the fear of being average,” Swift has stated. Has Swift cracked the songwriting code? Or are Taylor Swift lyrics exactly that; average? So formulaic that they can be replicated by AI?

### Example of Swift lyrics (excerpt from “Style”):

Midnight, you come and pick me up, no headlights  
Long drive, could end in burning flames or paradise  
Fade into view, oh,  
It's been a while since I have even heard from you  
(Heard from you)  
And I should just tell you to leave 'cause I  
Know exactly where it leads but I  
Watch it go round and round each time  
You got that James Dean daydream look in your eye  
And I got that red lip, classic thing that you like  
And when we go crashing down, we come back every time  
'Cause we never go out of style, we never go out of style  
So it goes, he can't keep his wild eyes on the road  
Takes me home, lights are off he's taking off his coat (Hm yeah)  
I say "I've heard that you've been out and about with some other girl, some other girl"  
He says "What you've heard is true but I  
Can't stop thinking about you" and I  
I said "I've been there too a few times"  
'Cause you got that James Dean daydream look in your eye  
And I got that red lip, classic thing that you like  
And when we go crashing down, we come back every time  
'Cause we never go out of style, we never go out of style  
You've got that long hair slick back, white t-shirt  
And I got that good girl faith and a tight little skirt (A tight little skirt)  
And when we go crashing down, we come back every time  
'Cause we never go (We never go) out of style, we never go out of style

## Methodology

The GPT-2 model was trained by being fed every song from all 7 of Swift's albums, totaling around 120 songs. The model was fine-tuned for 5000 epochs with samples of new text being generated every 200 epochs while training and then twice more once fully trained so that the progress could be monitored.

## Results

### Sample 1:

I don't know why I bother running after you  
I'm just gonna stay where I am,  
I'm just gonna stay where I am  
And I don't wanna bother you anymore,  
If you don't wanna call,  
When I'm through  
I'd better stay in my room  
'Cause you're not gonna see me get up  
And go to your door in the middle of the night  
'Cause you're not gonna see me walk in the door  
...  
You held me close and you should've,  
Should've locked me out of your home,  
Should've driven us far, far away,  
Should've loved me with all your heart,  
Should've waited all those years,  
To get to know me only through your eyes  
And this is when the lines blur  
Reassure me that you understand  
But the hatred burns so high in me  
And I'm just gonna stay where I am, I'm  
just gonna stay where I am  
And I don't wanna bother you anymore,  
If you don't wanna call,  
When I'm through  
I'd better stay in my room  
'Cause you're not gonna see me get up  
And go to your door in the middle of the night  
'Cause you're not gonna see me walk in the door

### Sample 2:

I don't know what you're thinking  
Isolation is the acceptable route  
I'm closing the door behind me  
I'm closing the door behind me  
I'm so frustrated I could cry  
All I want is you, right there, right now  
Just right now, right now  
It's liberating, be aware of your surroundings  
I'm so furious, I'd never play games with you  
So dejected I'd rather kill you than ever play with you  
Stop this, you're unapologetic  
I'm so furious, I'd never play games with you  
I know it's wrong, but you're the one thing I hate  
So dejected I'd never play games with you  
So dejected I'd never play games with you  
So dejected I'd never play games with you  
It's liberating, be aware of your surroundings  
I'm so furious, I'd never play games with you  
I know it's wrong, but games with you  
I know it's wrong, but games with you  
Oh, games with you  
With you

### Sample 3:

Love is scary, but it's life, it's true  
Let it go, love has its perks  
I'm waiting for you, I'll be with you  
As it were, I'm waiting for you  
Just like old times, we're in the middle of the woods  
Take a right, we're home  
'Cause we're never going back to square one  
Take a left, take a left  
Just like old times, we're in the middle of the woods  
Take a left, take a left  
Just like old times, we're in the middle of the woods  
'Cause we're never going back to square one

### Sample 4:

You've got my number, call me when you need me  
Call me when you need to say that I'm yours yet again to hold  
Oh, whoa, whoa  
It's new  
Nothing's as it seems  
I'm so confused  
Then I see your face and I'm like wow  
You've got me at 'em now  
So whoa, whoa  
Let's try and be friends  
I need your guidance  
But you tell me exactly what I need to know  
And you've got my number, call me whenever you need me  
Call me whenever you need to say that  
I'm yours yet again, I'll support you wherever you take us  
And I'll support you wherever you take me  
Oh, ooh  
Call me when you need to say that I'm yours yet again, I'll support you wherever you take us  
And I'll support you wherever you take me  
Oh, ooh

### Sample 5:

Remembering this moment  
Is never easy  
But letting it go  
Is magical  
How can I ever try to do that?  
I don't wanna sound like a sad song  
I don't wanna sound like a sad song  
But I really do wanna try  
'Cause it's never too late  
Just think this through  
'Cause it's never too late  
Just think this through

### Noteworthy Excerpts from Various Samples:

“He's a poet when he's asleep/ Writer of sweet lies, wicked secrets, darling”

“The lights are on and I've got the key/ But you just looked away/ All this time we've been playing/ Like two young lovers/ And this is no fair game/ Can you see the fire?”

“Your worthless insults fill the air”

“Long were the nights when my days once revolved around you/ Counting my footsteps,/ Praying the floor won't fall through, again/ My mother accused me of losing my mind,/ But I swore I was fine, you paint me a blue sky/ And go back and turn it to rain, that's all I've ever wanted, to be somewhere else/ And you walk away with a perfect score/ Today is all about you and me”

## Analysis

The model was able to successfully identify the common motifs in Swift's lyrics: love, heartbreak, unrequited love, moving on, confusion, cheating, revenge, womanhood, etc. The model also properly generated melody lines to be repeated throughout the songs. Though some songs were not always successful as a whole and often lacked continuity, every epoch did contain valuable and original lyrics. An example is, “And I remember thinking, oh my God, oh my God/ It's two in the morning/ How can one human being be so heartless?/ How can one be so heartless?”

In order to achieve powerful metaphors, Swift often uses graphic and sometimes violent imagery, such as setting things on ablaze, referencing wars, fights, the intoxicating effects of love, and much more. What the AI did well was in being able to pick up Swift's graphic tone in many ways and replicating that. However, within this tone it often failed to replicate the proper subject, sometimes leaving the lyrics to be more of an eerie horror story rather than a breakup song. Instead of love tropes, the model sometimes referenced murder, injuries (i.e. burns, bruises, slashed faces, scars), doping, drinking, pregnancies, illegitimate children, and even sexual assault. At one point, it depicted the story of a scared girl hiding under her bedsheets one murderous night. I would not call this unsuccessful but rather sheds more light onto the dark and dramatic imagery Swift uses in her songs about love and heartache to connect to others.

With each increasing epoch, GPT-2 generated more comprehensible and creative lyrics, using many words and themes that do not exist in Swift's lyrics themselves. This means that the model improved with more training and increased originality in the composition of song lyrics.

## Further Research

GPT-2 proved successful in creating metaphors and formulating compelling lines, but lacked continuity throughout the storytelling of a song's lyrics. In order to write a more cohesive song, this model would have to be trained on a much larger dataset, possibly including some of Swift's contemporary pop artists.

## Acknowledgements

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